IN THE CLAIMS:

1. A catalyst composition useful in the polymerization of olefins comprising a mixture of

a) an aluminum compound represented by the formula

$$Al(X)_a(Y)_b(Z)_c$$

wherein

Al is an aluminum atom;

X is a hydrocarbyl group;

Y is a hydrocarbyloxy group;

Z is selected from hydrogen or halogen;

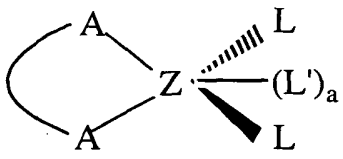
and each a, b, c is an integer of 0-3 provided the sum of a+b+c is 3;

b) inorganic oxide having from 0.01 to 12 mmole/gram of surface hydroxyl groups; and

c) a transition metal complex selected from bidentate transition metal compounds, tridentate transition metal compounds and mixtures thereof and wherein said transition metal is selected from Fe, Co, Ni, Ru, Rh, Pd, Os, Ir, Pt, Ti, Zr or Hf;

said components being present in amounts to provide 0.001 to 2.1 mmol of aluminum and from 1 to 1000 μmol of transition metal per gram of inorganic oxide and a mole ratio of aluminum to transition metal of from 1:1 to 75:1.

2. The catalyst composition of Claim 1 wherein the transition metal compound is a bidentate transition metal complex represented by the formula



II

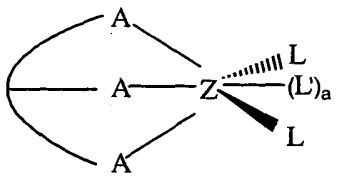
wherein

i) each A independently represents an oxygen, sulfur, phosphorus or nitrogen atom;

ii) Z represents a transition metal selected from Fe, Co, Ni, Ru, Rh, Pd, Os, Ir or Pt in the +2 or +3 oxidation state or Ti, Zr or Hf in the +2, +3 or +4 oxidation state;

iii) each L and L′ independently represents an anionic ligand group selected from the group consisting of hydrogen, halogen, unsubstituted or substituted hydrocarbon based radical or both L, together with Z represents a C_3-C_{24} hydrocarbylene structure.

3. The catalyst composition of Claim 1 wherein the transition metal compound is a tridentate transition metal complex represented by the formula



III

wherein

i) each A independently represents an oxygen, sulfur, phosphorous or nitrogen atom;

ii) Z represents a transition metal selected from Fe, Co, Ni, Ru, Rh, Pd, Os, Ir or Pt in the +2 or +3 oxidation state or Ti, Zr, or Hf in the +2, +3 or +4 oxidation state;

iii) each L and L′ independently represents an anionic ligand group selected from the group consisting of hydrogen, halogen, unsubstituted or substituted hydrocarbon based radical or both L, together with Z represents a C_3-C_{24} hydrocarbylene structure.

4. The catalyst composition of claim 2 or 3 wherein each A represents a nitrogen atom, each L and L′ is independently selected from a halogen atom, or a hydrocarbyl or mixtures thereof or both L together form a hydrocarbylene group which, with Z, forms a 3 to 7 member ring structure.

5. The catalyst composition of Claim 2 or 3 wherein "a" of the aluminum compound is 1 to 3 and each L of the transition metal compound is selected from halogen atom.

6. The catalyst composition of Claim 2 or 3 wherein at least one L of the transition metal complex is selected from hydrocarbyl.

7. The catalyst of Claim 4 wherein Z is selected from Ni, Pd, Fe or Co.

8. The catalyst composition of Claim 2 wherein Z is selected from Ni or Pd and each L is independently selected from chlorine, bromine, iodine or a C_1-C_8 alkyl group.

9. The catalyst composition of Claim 3 wherein Z is selected from iron or cobalt and each L is independently selected from chlorine, bromine, iodine or a C_1-C_8 alkyl group.

10. The catalyst composition of Claim 1 wherein "a" of the aluminum compound is 3.

11. The catalyst composition of Claim 2 wherein "a" of the aluminum compound is 3.

12. The catalyst composition of Claim 3 wherein "a" of the aluminum compound is 3.

13. The catalyst composition of Claim 4 wherein "a" of the aluminum compound is 3.

14. The catalyst composition of Claim 5 wherein "a" of the aluminum compound is 3.

15. The catalyst composition of Claim 7 wherein "a" of the aluminum compound is 3.

16. The catalyst composition of Claim 8 wherein "a" of the aluminum compound is 3.

17. The catalyst composition of Claim 9 wherein "a" of the aluminum compound is 3.

18. The catalyst composition of Claim 1 wherein the inorganic oxide has total volatile of 0.1 to about 4 weight percent, surface hydroxyl groups of from 0.1 to 5 mmol/g and a surface area of from 10 to 1000 m^2/g.

19. The catalyst composition of Claim 10 wherein the inorganic oxide has total volatile of 0.1 to about 4 weight percent, surface hydroxyl groups of from 0.1 to 5 mmol/g and a surface area of from 10 to 1000 m^2/g.

20. The catalyst composition of Claim 11 wherein the inorganic oxide has total volatile of 0.1 to about 4 weight percent, surface hydroxyl groups of from 0.1 to 5 mmol/g and a surface area of from 10 to 1000 m^2/g.

21. The catalyst composition of Claim 12 wherein the inorganic oxide has total volatile of 0.1 to about 4 weight percent, surface hydroxyl groups of from 0.1 to 5 mmol/g and a surface area of from 10 to 1000 m^2/g.

22. The catalyst composition of Claim 13 wherein the inorganic oxide has total volatile of 0.1 to about 4 weight percent, surface hydroxyl groups of from 0.1 to 5 mmol/g and a surface area of from 10 to 1000 m^2/g.

23. The catalyst composition of Claim 14 wherein the inorganic oxide has total volatile of 0.1 to about 4 weight percent, surface hydroxyl groups of from 0.1 to 5 mmol/g and a surface area of from 10 to 1000 m^2/g.

24. The catalyst composition of Claim 15 wherein the inorganic oxide has total volatile of 0.1 to about 4 weight percent, surface hydroxyl groups of from 0.1 to 5 mmol/g and a surface area of from 10 to 1000 m^2/g.

25. The catalyst composition of Claim 16 wherein the inorganic oxide has total volatile of 0.1 to about 4 weight percent, surface hydroxyl groups of from 0.1 to 5 mmol/g and a surface area of from 10 to 1000 m^2/g.

26. The catalyst composition of Claim 17 wherein the inorganic oxide has total volatile of 0.1 to about 4 weight percent, surface hydroxyl groups of from 0.1 to 5 mmol/g and a surface area of from 10 to 1000 m^2/g.

27. The catalyst composition of Claim 1, 10 or 18 wherein the inorganic oxide is silica.

28. The catalyst composition of Claim 1, 10, or 18 wherein said aluminum compound is present in an amount to provide from about 0.01 to 1.9 mmol of Al per gram of inorganic oxide; said transition metal complex is present in an amount to provide from 5 to 500 μmoles of transition metal per gram of inorganic oxide and said aluminum to transition metal is in a molar ratio of 1:1 to 50:1.

29. The catalyst composition of Claim 27 wherein said aluminum compound is present in an amount to provide from about 0.01 to 1.9 mmol of Al per gram of inorganic oxide; said transition metal complex is present in an amount to provide from 5 to 500 μmoles of transition metal per gram of inorganic oxide and said aluminum to transition metal is in a molar ratio of 1:1 to 50:1.

30. A catalyst composition useful in the polymerization of olefins formed by contacting, in an inert liquid, the components comprising:

a) an aluminum compound represented by the formula

$$Al(X)_a(Y)_b(Z)_c$$

wherein

Al is an aluminum atom;

X is a hydrocarbyl group;

Y is a hydrocarbyloxy group;

Z is selected from hydrogen or halogen;

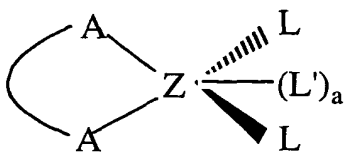
and each a, b, c is an integer of 0-3 provided the sum of a+b+c is 3;

b) inorganic oxide having from 0.01 to 12 mmole/gram of surface hydroxyl groups; and

c) a transition metal complex selected from bidentate transition metal compounds, tridentate transition metal compounds and mixtures thereof and wherein said transition metal is selected from Fe, Co, Ni, Ru, Rh, Pd, Os, Ir, Pt, Ti, Zr or Hf;

said components being present in amounts to provide 0.001 to 2.1 mmol of aluminum and from 1 to 1000 μmol of transition metal per gram of inorganic oxide and a mole ratio of aluminum to transition metal of from 1:1 to 75:1.

31. The catalyst composition of Claim 30 wherein the transition metal compound is a bidentate transition metal complex represented by the formula



II

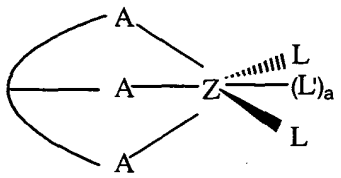
wherein

i) each A independently represents an oxygen, sulfur, phosphorus or nitrogen atom;

ii) Z represents a transition metal selected from Fe, Co, Ni, Ru, Rh, Pd, Os, Ir or Pt in the +2 or +3 oxidation state or Ti, Zr or Hf in the +2, +3 or +4 oxidation state;

iii) each L and L′ independently represents an anionic ligand group selected from the group consisting of hydrogen, halogen, unsubstituted or substituted hydrocarbon based radical or both L, together with Z represents a C_3-C_{24} hydrocarbylene structure.

32. The catalyst composition of Claim 30 wherein the transition metal compound is a tridentate transition metal complex represented by the formula



III

wherein

i) each A independently represents an oxygen, sulfur, phosphorous or nitrogen atom;

ii) Z represents a transition metal selected from Fe, Co, Ni, Ru, Rh, Pd, Os, Ir or Pt in the +2 or +3 oxidation state or Ti, Zr, or Hf in the +2, +3 or +4 oxidation state;

iii) each L and L′ independently represents an anionic ligand group selected from the group consisting of hydrogen, halogen, unsubstituted or

substituted hydrocarbon based radical or both L, together with Z represents a C_3-C_{24} hydrocarbylene structure.

33. The catalyst composition of claim 31 or 32 wherein each A represents a nitrogen atom, each L and L′ is independently selected from a halogen atom, or a hydrocarbyl or mixtures thereof or both L together form a hydrocarbylene group which, with Z, forms a 3 to 7 member ring structure.

34. The catalyst composition of Claim 31 or 32 wherein "a" of the aluminum compound is 1 to 3 and each L of the transition metal compound is selected from halogen atom.

35. The catalyst composition of Claim 31 or 32 wherein at least one L of the transition metal complex is selected from hydrocarbyl.

36. The catalyst of Claim 30 wherein Z is selected from Ni, Pd, Fe or Co.

37. The catalyst composition of Claim 31 wherein Z is selected from Ni or Pd and each L is independently selected from chlorine, bromine, iodine or a C_1-C_8 alkyl group.

38. The catalyst composition of Claim 32 wherein Z is selected from iron or cobalt and each L is independently selected from chlorine, bromine, iodine or a C_1-C_8 alkyl group.

39. The catalyst composition of Claim 30 wherein "a" of the aluminum compound is 3.

40. The catalyst composition of Claim 31 wherein "a" of the aluminum compound is 3.

41. The catalyst composition of Claim 32 wherein "a" of the aluminum compound is 3.

42. The catalyst composition of Claim 33 wherein "a" of the aluminum compound is 3.

43. The catalyst composition of Claim 34 wherein "a" of the aluminum compound is 3.

44. The catalyst composition of Claim 35 wherein "a" of the aluminum compound is 3.

45. The catalyst composition of Claim 36 wherein "a" of the aluminum compound is 3.

46. The catalyst composition of Claim 38 wherein "a" of the aluminum compound is 3.

47. The catalyst composition of Claim 30 wherein the inorganic oxide has total volatile of 0.1 to about 4 weight percent, surface hydroxyl groups of from 0.1 to 5 mmol/g and a surface area of from 10 to 1000 m^2/g.

48. The catalyst composition of Claim 39 wherein the inorganic oxide has total volatile of 0.1 to about 4 weight percent, surface hydroxyl groups of from 0.1 to 5 mmol/g and a surface area of from 10 to 1000 m^2/g.

49. The catalyst composition of Claim 40 wherein the inorganic oxide has total volatile of 0.1 to about 4 weight percent, surface hydroxyl groups of from 0.1 to 5 mmol/g and a surface area of from 10 to 1000 m^2/g.

50. The catalyst composition of Claim 41 wherein the inorganic oxide has total volatile of 0.1 to about 4 weight percent, surface hydroxyl groups of from 0.1 to 5 mmol/g and a surface area of from 10 to 1000 m^2/g.

51. The catalyst composition of Claim 42 wherein the inorganic oxide has total volatile of 0.1 to about 4 weight percent, surface hydroxyl groups of from 0.1 to 5 mmol/g and a surface area of from 10 to 1000 m^2/g.

52. The catalyst composition of Claim 43 wherein the inorganic oxide has total volatile of 0.1 to about 4 weight percent, surface hydroxyl groups of from 0.1 to 5 mmol/g and a surface area of from 10 to 1000 m^2/g.

53. The catalyst composition of Claim 44 wherein the inorganic oxide has total volatile of 0.1 to about 4 weight percent, surface hydroxyl groups of from 0.1 to 5 mmol/g and a surface area of from 10 to 1000 m^2/g.

54. The catalyst composition of Claim 45 wherein the inorganic oxide has total volatile of 0.1 to about 4 weight percent, surface hydroxyl groups of from 0.1 to 5 mmol/g and a surface area of from 10 to 1000 m^2/g.

55. The catalyst composition of Claim 46 wherein the inorganic oxide has total volatile of 0.1 to about 4 weight percent, surface hydroxyl groups of from 0.1 to 5 mmol/g and a surface area of from 10 to 1000 m^2/g.

56. The composition of Claim 30, 39, or 47 wherein the inorganic oxide is silica.

57. The catalyst composition of Claim 30, 39 or 47 wherein said aluminum compound is present in an amount to provide from about 0.01 to 1.9 mmol of Al per gram of inorganic oxide; said transition metal complex is present in an amount to provide from 5 to 500 μmoles of transition metal per gram of inorganic oxide and said aluminum to transition metal is in a molar ratio of 1:1 to 50:1.

58. The catalyst composition of Claim 56 wherein said aluminum compound is present in an amount to provide from about 0.01 to 1.9 mmol of Al per gram of inorganic oxide; said transition metal complex is present in an amount to provide from 5 to 500 μmoles of transition metal per gram of inorganic oxide and said aluminum to transition metal is in a molar ratio of 1:1 to 50:1.

59. The catalyst composition of Claim 30, 31, 32, 36, 37, 38, 39, 40, 41, 45, 46, 47, 48, 49 or 50 wherein the components are sequentially introduced into the inert liquid in the order of first component a), followed by component b), and then followed by component c).

60. The catalyst composition of Claim 30, 31, 32, 36, 37, 38, 39, 40, 41, 45, 46, 47, 48, 49 or 50 wherein components a), b) and c) are substantially simultaneously introduced into the inert liquid and maintained therein at temperatures of from 0° to 50° C and atmospheric pressure.

61. The catalyst composition of Claim 30, 31, 32, 36, 37, 38, 39, 40, 41, 45, 46, 47, 48, 49 or 50 wherein components a), b) and c) are introduced into the inert liquid maintained at from 0° to 50°C for a period of time of from 0.5 min to 60 minutes and recovering the solid mixture from the liquid.

62. The catalyst composition of Claim 30, 31, 32, 36, 37, 38, 39, 40, 41, 45, 46, 47, 48, 49 or 50 wherein the components a), b) and c) are directly introduced into an olefin polymerization reaction zone.

63. A process for the polymerization of an olefin compound comprising contacting in a reaction zone one or more olefin monomers with the catalyst composition of Claim 1.

64. A process for the polymerization of an olefin compound comprising contacting in a reaction zone one or more olefin monomers with the catalyst composition of Claim 30.

65. The process of Claim 63 or 64 wherein at least one of said olefin monomers is ethylene.

66. The process of Claim 63 or 64 wherein the olefin monomers comprise at least one alpha-olefin and at least one functionalized ethylenically unsaturated monomer.

67. The process of Claim 63 or 64 wherein the catalyst composition is introduced into the reaction zone as a dispersion in an inert liquid.

68. The process of Claim 63 or 64 wherein the components a), b) and c) are directly introduced into the reaction zone.

69. A process for forming a catalyst useful in the polymerization of olefins comprising contacting, in an inert liquid, the components:

a) an aluminum compound represented by the formula

$$Al(X)_a(Y)_b(Z)_c$$

wherein

Al is an aluminum atom;

X is a hydrocarbyl group;

Y is a hydrocarbyloxy group;

Z is selected from hydrogen or halogen;

and each a, b, c is an integer of 0-3 provided the sum of a+b+c is 3;

b) inorganic oxide having from 0.01 to 12 mmole/gram of surface hydroxyl groups; and

c) a transition metal complex selected from bidentate transition metal compounds, tridentate transition metal compounds and mixtures thereof and wherein said transition metal is selected from Fe, Co, Ni, Ru, Rh, Pd, Os, Ir, Pt, Ti, Zr or Hf;

said components being present in amounts to provide 0.001 to 2.1 mmol of aluminum and from 1 to 1000 μmol of transition metal per gram of inorganic oxide and a mole ratio of aluminum to transition metal of from 1:1 to 75:1.

70. The process of Claim 69 wherein the components a), b) and c) are contacted substantially simultaneously.